Key Performance Indicators in Occupational Health and Safety of Hospitals: A systematic review with meta-analysis protocol

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Key Performance Indicators in Occupational Health and Safety of Hospitals: A systematic review with meta-analysis protocol

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Abstract

Objective: The purpose for conducting the review is to examine studies which have been carried out on Occupational Health and Safety (OHS) in hospitals using Key Performance Indicators (KPIs). We will determine if these studies take into account institutional categories.

Introduction: The developing application of KPIs in hospitals takes into account some particular conditions for OHS in the health sector. The application of KPIs in OHS of hospitals is connected to institutional directives for OHS. We will determine if these studies take into account institutional categories such as Protective and Preventive Services (PPS), Risk Assessment (RA) and Management Systems (OHSMS).

Inclusion criteria: We will include studies which use KPIs in the evaluation of OHS in hospitals, (those related directly and indirectly to OHS). We exclude the following categories of study: Studies which use KPIs in hospital evaluations, but which are not oriented to OHS and studies which include KPIs in evaluating various organizations but not exclusively hospitals.

Methods: We will conduct electronic searches for eligible studies within each of the following databases: PubMed, Scopus, Heal-link, Google Scholar. With the help of the JBI tool and using inclusion/exclusion criteria, two independent reviewers will determine which studies will be selected or not. Those studies which fulfill the inclusion criteria will be subjected to a post analysis data procedure. We intend to use mixed methods and workflow software.

Results (as expected outcomes): Examination of the relationship between KPIs in OHS of hospitals and the institutional representations for OHS, using the Data Analysis methods.

Conclusions: The conclusions will depend on the results of the relationship between KPIs in OHS of hospitals and the institutional representations.

1. Introduction

KPI are indicators which are used widely to gauge the performance of a company or organisation (Setiawan, & Purba, 2020). Asih, Purba, & Sitorus, (2020) refer to the importance of quantification and adaptation in the objective targets of KPIs.
Silvestri, Falcone, DiBona, Forcina, & Gemmiti, (2021), provided a tool for the integrated evaluation of all the performances of a company, starting from the definition of some KPIs which could be recommended for a particular case study. LaFata, Giallanza, Micale, & LaScalia (2021) developed methodology, also using KPIs in which Multi Criteria Decision Making is used in the prioritisation of occupational hazards. Cheng, Lin, Liou, Hsiao, & Liu, (2019) created an evaluation questionnaire, with the aid of the Delphi method, in order to seek opinions on OHS with specialised and professional criteria. Subsequently, the KPIs for OHS were discussed and redefined. According to Pęciłło (2016) certain convincing evidence regarding the effectiveness of OHSMS is linked to the application of OHS (KPIs). However, references are also made to the fact that OHSMS are not strongly connected to KPIs. It is also difficult to ascertain the elements which truly influence the level of safety in an organisation. It is worth noting that the highly formalised and rigid nature of OHSMS and the KPIs used, render them ineffective when dealing with emerging challenges and dangers. The European Agency for Health and Safety at Work (2021) developed and provided reliable information regarding the application of KPIs in OHS, in terms of good governance, outreach capacity of intermediaries through networking and purpose of use. The developing application of KPIs in hospitals takes into account the particular conditions for OHS in the health sector. Performance Indicators that can be used in hospitals, clinics, or dialysis departments, were developed by Liu & Itoh (2013). They used interviews in the form of a questionnaire in order to select a sum of indicators and validation tests. In another case of a central hospital system with radiation protection services, objective quantifiable data was used in order to shape performance indicators which concern OHS. Through the formation and use of indicators over a period of more than ten years, an objective comparative evaluation of radiation protection programs in the health sector is created. (Schultz, Shaffer, Fink-Bennett, & Winokur, 2016).
The application of KPIs in OHS of organisations is connected to institutional directives for OHS. Such directives include PPS which are provided both by large multi-scientific services and by isolated individuals, such as an Occupational Physician (OP) or Safety Technician (ST). PPS are provided according to article 7 of the Framework Directive 89/391 of the EE. The laws were created before the directive or were incorporated into the domestic law of the member states (Walters, Johnstone, Bluff, Limborg, & Gensby, 2022). The application of Risk Assessment, which is an important institutional tool for OHS and for Occupational Health and Safety Management

Systems (OHSMS) is used in order to create tools for the integration of management systems and the creation of basic KPIs indicators which can be used in studies related to OHS. (Silvestri, Falcone, DiBona, Forcina, & Gemmiti, 2021).

The need for a deep review emerges from existing literature review on the topic. We will analyze in detail the existence of the specific institutional representations in the KPIs studies for OHS in hospitals. KPIs studies for OHS in hospitals are found in the literature. However, there are no studies that have taken into account the specific institutional representations.

The implementation of PPS, and in particular Safety Technician (ST), Occupational Physician (OP), RA and OHSMS is of particular importance for OHS in any organization in general and more so in hospitals. Without this implementation, OHS cannot be achieved. These institutional representations are most often mentioned in studies of OHS in hospitals.

However, an important bibliographic gap is identified. We try to fill this gap by answering the question of our study. Fragmentary evidence showing the existence of studies meeting the inclusion criteria was found in the studies by Khapre et al. (2022) and Wagner et al. (2019).

A preliminary search of PROSPERO, MEDLINE, the Cochrane Database of Systematic Reviews, and JBI Evidence Synthesis was conducted, and no current or in-progress systematic reviews on the topic were identified.

Podgorski has developed an analytical framework for KPI implementation. We are going to analyse the elements of the Podgorski framework in table 1.

Table 1: The final set of KPIs assigned to individual OHS MS components (Podgorski, 2015).

OSH MS component	KPIs (main and alternative)
Policy	
A. OSH policy	**A1: Number of OSH policy reviews and updates carried out by top management.** A2: Percentage of workers desiring good knowledge by top managers
B. Worker's participation Organizing	**B1: Number of OSH improvements proposed by workers.** B2: Number of OSH Commission meetings on regular OSH issues
C. Responsibilities and accountability	**C1. Percentage of work posth with defined OSH responsibilities and duties**

D. Evaluation and improvement of OSH training programs	**D1. Percentage of workers participating in OSH refresher courses.** D2. Number of hours for OSH training per person.
E. Evaluation and improvement of OSH training programs	**E1. Percentage of OSH MS procedures improved**
F. OSH MS documentation	**F1: Percentage of OSH MS procedures improved duo to corrective actions.** F2: Percentage of workers participating in training on OSH MS structure, procedures etc.
G. Communication	**G1: Number of meetings conducted by managers to inform workers on OSH issues.** G2: Rating of the effectiveness of OSH communication via workforce survey G3: Number of issues of companies OSH bulletin or other internal OSH publications.
Planning and implementation	
H. OHS goals and implementation plans	**H1: Number of measurable OSH improvement goals established in the enterprise.** H2: Percentage of tasks in OSH improvement goals established in the enterprise
I. Risk assessment processes	**I1: Percentage of periodically verified risk assessment processes with regard to their validity and correctness of risk control measures applied.**
J. Implementation of risk control measures	**J: Percentage of workers informed on risk levels and risk control measures applied**
K. Management of change	**K1: Number of analyses of impact on OSH carried out with regard to changes in OSH regulations technologies and knowledge.** K2: Percentage of workstation with risk assessment verified in course of introduction of new machinery, materials, changing work method etc.
L. Emergency preparedness and response	**L1: Percentage of workers trained on emergency procedures, including rescue activities and first aid**
M. Procurement	M1: Percentage of periodically verified OSH requirements applied in purchase specifications
N. Contracting	**N1: Number of contractors assessed for their compliance with OSH management requirements**

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Evaluation

O. Performance monitoring and measurement	**O1: Percentage of definitions of leading and lagging performance indicators subject to periodical review and update**
P. Investigation of work-related accident, diseases and incidents and their impact on OSH	**P1: Number of corrective and preventive actions carried out as a result of root causes analyses of work-related accidents, diseases and incidents**
	P2: Percentage of medical consultations carried out within the program of workers' health surveillance
Q. Management system audit	**Q1: Percentage of OSH MS components or processes subject to assessment during internal OSH MS audits**
R. Management review	**R1: Percentage of recommended actions formulated by top managers at OSH MS reviews considered in OSH improvements plans**
Action for improvement	
S. Preventive and corrective action	**S1: Percentage of completed corrective and preventive actions in relation to all actions initiated by OSH MS audits and reviews, OSH performance monitoring, and root cause analyses of work-related accidents, incidents and diseases**
	S2: Percentage of completed corrective actions reviewed and evaluated for their effectiveness
T. Continual improvement	**T1: Number of new OSH goals and objectives established in the framework of OSH MS continual improvement**
	T2: Number of OSH management KPIs subject to benchmarking with other companies

Main KPIs are indicated in bold.
We will find the elements of the institutional representations from the literature review and classify them into the categories of Podgorski's framework.

2. Review question

Occupational Health and Safety (OSH) (P) studies with the use of Key Performance Indicators (KPI) take into account the role of institutional directives for OHS (O), in other words how Protective and Preventive Services (PPS), Safety Technicians (ST), Occupational Physicians (OP), Risk Assessment (RA) and Occupational Health and Safety Management Systems (OHSMS) influence OSH (I)? (According to PICO model).

3. Inclusion criteria

3.1 Participants

We will include studies which use KPIs in the evaluation of OHS in hospitals, (in other words those related directly and indirectly to OHS). In our study we utilise studies which concern the use of KPIs in the evaluation of OHS in hospitals. We will consider the number of hospitals included in these studies as well as the number of workers (medical, nursing, and administrative staff) exposed to risks and to whom OHS services must be provided.

Inclusion criterion: studies using KPIs in OHS in hospitals (with reference to OSH-related subject matter) and directly related to OSH are included.

We exclude the following categories of study:

• Studies which use KPIs in hospital evaluations, but which are not oriented to OHS;

• Studies which include KPIs in evaluating various organizations but not exclusively hospitals and whose results apply to a wide range of organizations differ greatly in meaning to the present study;

• Post-analysis of the theme under study, or relevant studies;

We will include studies which have been published in English or in French. Exposure: We include the exposure of employees to occupational risk in hospitals. Such categories of employees are doctors and nursing staff but not administrative staff.

3.2 Intervention(s)

The intervention of ST and OP, in the KPIs in hospitals, is important for the creation of a safe working environment, as it happens in other categories of businesses. We will identify information on PPS (in particular the provision of ST and OP services) within the KPIs studies in OHS in hospitals.

Through these studies we will analyze the impact of PPS in hospital OHS and KPIs. For example, one ST has worked on developing KPIs in hospitals. The reverse will also be considered: Have the KPIs in OHS in hospitals taken into account the work of the ST?

The intervention of RAs and OHSMS is of great importance for OHS in hospitals. This intervention must be reflected in the KPIs studies for hospitals. We will identify information on the development of RAs and the implementation of OHSMS in hospitals. Both the development of an RA and the implementation of an OHSMS contribute to the creation of a modern working environment in businesses and organizations. Has this been extended to hospitals? Do hospital KPIs studies consider RA and OHSMS?

3.3 Comparator(s)

We compare the evidence for the implementation of KPIs in OHS in hospitals, with the provision of PPS in hospitals. Then we compare the evidence for the implementa-

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tion of OHS KPIs in hospitals with the implementation of OHSMS and RAs. All the elements of the institutional representations are compared with each other and with the whole, in order to extract the results that will give the possibility to describe the role of each one in the context of the subject under consideration.

We will use elements of the Data Analysis to find the similarities between the variables and their influence on the subject of our research. We will calculate the following: Max, Mean, Std. Dev., Variance, Skewness, Kyrtosis. Pearson's correlation coefficient and p-value correlation will be used using the KNIME software.

3.4 Types of studies

This review will examine all studies using KPIs in OHS in hospitals (with reference to the OSH-related examination subject and directly related to OSH. This means that it is sought to collect and examine studies that have a conceptual association with OHS in hospitals, based on their content and not only on the basis of the used terminology. Theoretical frameworks, integrated models, case studies, questionnaire analysis studies, time-series studies, cohort studies, analytical cross-sectional studies and qualitative studies related to the topic under consideration will be examined. They will not be considered studies which use KPIs in hospital evaluations, but which are not oriented to OHS, studies which include KPIs in evaluating various organizations but not exclusively hospitals and whose results apply to a wide range of organizations differ greatly in meaning to the present study, post-analysis of the theme under study, or relevant studies and Systematic Reviews of the theme in question. After that, we will make some changes in the present protocol, for documenting important protocol amendments.

4. **Methods**

The proposed systematic review will be conducted in accordance with JBI methodology for systematic reviews JBI Manual for Evidence Synthesis, 2020 (Aromataris E, Munn Z, 2020). The selection of the review elements will be conducted according to the JBI Manual for Evidence, Scoping Reviews (Chapter 11). Peters, Godfrey, McInerney, Munn, Tricco, Khalil, et al.

The study has been registered in the Prospero Register and in the OSF Register. Registration number for the protocol: Prospero Registration: CRD42023444351/27/07/2023; Submission number 444351/16-07-2023 OSF Registration (Farantos, & Dounias, 2023).

4.1 Search strategy

The search strategy will aim to locate both published and unpublished studies. An initial limited search of PubMed, Scopus, Heal-link and Google Scholar was undertaken to identify articles on the topic. The text words contained in the titles and abstracts of relevant articles, and the index terms used to describe the articles were used to develop a full search strategy for PubMed, Scopus, Heal-link and Google Scholar.

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The following terms were searched individually in all the used databases:

- Protective/ or Protective Services/ or Services;
- Preventive/ or Preventive Services/ or Protective Preventive Services/ or PPS;
- Safety / or Safety Technician/ or ST;
- Technician;
- Doctor/ or Occupational Doctor;
- Physician/ or Occupational physician;

The search strategy, including all identified keywords and index terms, will be adapted for each included information source. The reference lists of all studies selected for critical appraisal will be screened for additional studies. Studies published in English and French will be included. We will conduct electronic searches for eligible studies within each of the following databases:

- PubMed (1996 to October 2023);
- Scopus (1900 to October 2023);
- Heal-link (1999 to October 2023);
- Google Scholar (2004 to 2023);

We will also search the Register PROSPERO - International prospective register of systematic reviews (https://www.crd.york.ac.uk/PROSPERO/) and the source for grey literature- openGrey (formerly openSIGLE).

4.2 Study selection

Following the search, all identified citations will be collated and uploaded into Zotero software (Corporation for Digital Scholarship) and duplicates removed. Following a pilot test, titles and abstracts will then be screened by two independent reviewers for assessment against the inclusion criteria for the review. Potentially relevant studies will be retrieved in full, and their citation details imported into the JBI System for the Unified Management, Assessment, and Review of Information (JBI SUMARI; JBI, Adelaide, Australia), (Munn Z, Aromataris E, Tufanaru C, Stern C, Porritt K, Farrow J. 2019). The full text of selected citations will be assessed in detail against the inclusion criteria by two independent reviewers. Reasons for exclusion of full-text studies that do not meet the inclusion criteria will be recorded and reported in the systematic review. Any disagreements that arise between the reviewers at each stage of the study selection process will be resolved through discussion or with a third reviewer. The results of the search and study selection and inclusion process will be reported in full in the final systematic review and presented in a Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) flow diagram (Page, McKenzie, Bossuyt, Boutron, Hoffmann, Mulrow, et al., 2021).

4.3 Assessment of methodological quality

Eligible studies will be critically appraised by two independent reviewers at the study level, for methodological quality in the review using standardized critical appraisal instruments from JBI for experimental, quasi-experimental, and observational stud-

ies (Aromataris, Munn, 2020). Authors of papers will be contacted to request missing or additional data for clarification, where required. Any disagreements that arise between the reviewers will be resolved through discussion or with a third reviewer. The results of critical appraisal will be reported in a table with accompanying narrative. All studies, regardless of the results of their methodological quality, will undergo data extraction and synthesis. Quality scores will be tabulated with data extraction items and described in the text of the systematic review. Regardless of quality score, data will be extracted for all included studies and included in data synthesis. Quality scores will be recorded and reported in the systematic review.

4.4 Data extraction

In order to manage the relevant literature, we will use Zotero. Data will be extracted from studies included in the review by two independent reviewers using a modified JBI data extraction tool. In the modified data extraction tool, we have added details and results extracted from source of evidence (in relation to the concept of the scoping review) about KPI's, PPS, RA and OHSMS. With the help of the modified JBI data extraction tool and using inclusion/exclusion criteria, two independent reviewers will determine which studies will be selected or not. The results will be recorded on excel spreadsheets. The data extracted will include specific details about the populations, study methods, interventions, and outcomes of significance to the review question. Any disagreements that arise between the reviewers will be resolved through discussion or with a third reviewer. Authors of papers will be contacted to request missing or additional data, where required.

4.5 Data synthesis

Those studies which fulfill the inclusion criteria will be subjected to a post analysis data procedure. Studies will, where possible, be pooled with statistical meta-analysis using JBI SUMARI. In order for quantification to occur, post analysis will be carried out using KNIME software. A workflow will be constructed to extract results in the form of graphs, charts and correlation tables. Effect sizes will be expressed, and their 95% confidence intervals will be calculated for. Heterogeneity will be assessed statistically using the standard χ^2 and I^2 tests. Statistical analyses will be performed using fixed effects model (Tufanaru et al., 2015). Subgroup analyses will be conducted if there are sufficient data to investigate. Sensitivity analyses will be conducted to test decisions made regarding the effect of the presence or absence of a variable in relation to the set of variables. Where statistical pooling is not possible the findings will be presented in narrative form including tables and figures to aid in data presentation, where appropriate.
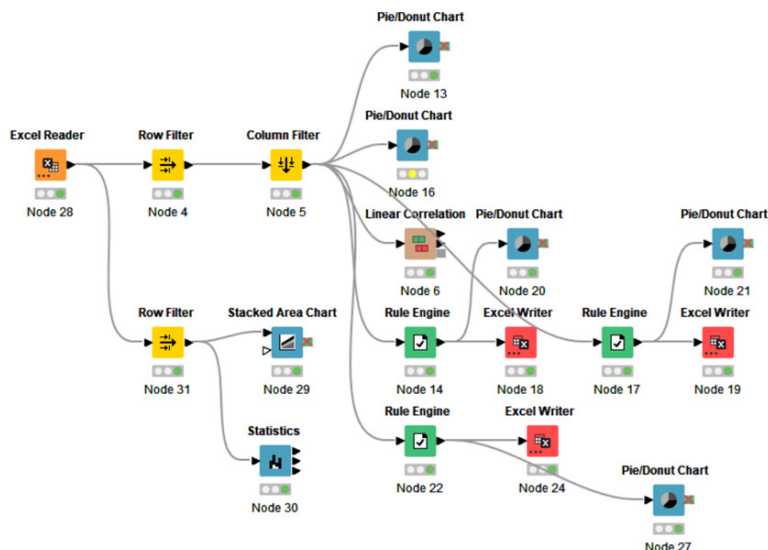
Fig.1: The temporary workflow that we designed for the data procession.

We will calculate basic measures of Descriptive Statistics, we will correlate the variables, and we will schedule nodes to characterise the results.

A funnel plot will be generated (robvis software) to assess publication bias if there are 10 or more studies included in a meta-analysis. Identification of any planned way to assess meta-biases (publication bias, data availability bias, and reviewer selection bias). Pre-specification of any methods used to explore the possibility that the data identified are biased due to non-study related processes. We strive to examine the studies to avoid:

- publication bias;
- data availability bias, and
- reviewer selection bias.

This evaluation will be made by two reviewers. If there is a discrepancy, evaluation will be carried out by a third reviewer.

As far as reporting bias is concerned, we will examine the date when the protocol of the study was posted and verify that it was prior to that of the actual study. We will examine outcome reporting bias to determine if selective reporting of results is evident. Statistical tests for funnel plot asymmetry (Egger test, Begg test, Harbord test) will be performed where appropriate.

5. **Results (as expected outcomes)**

Examination of the relationship between KPIs in OHS of hospitals and the institutional directives for OHS, in one of the following ways:

- Correlation between KPIs in OHS and PPS;
- Correlation between KPIs in OHS and the institutional framework for ST;
- Correlation between KPIs in OHS and the institutional framework for OP;
- Correlation between KPIs in OHS and the institutional framework concerning the application of OHSMS;
- Correlation between KPIs in OHS and the institutional directive regarding the application of RA;

The correlation between OHS in hospitals using KPIs and the institutional directives for OHS will be expressed as a combination of the individual correlations.

6. Additional Outcomes

Correlation between and comparison of institutional directives with KPI studies on hospital OHS, measured in one of the following ways:

1. Correlation between the institutional directives of ST and OP in hospitals.
2. Correlation between the institutional directives of PPS, OHSMS and RA in OHS of hospitals.
3. Correlation between the institutional directives of OHSMS and those of RA in OHS studies in hospitals.

The correlation between the relevant studies of OHS in hospitals using the institutional framework and those using KPIs will arise from the basis of statistical methods. Any papers which are not initially included, but which may supplement the study, may be examined. The results will be presented using visualisation methods.

7. Assessing certainty in the findings

The Grading of Recommendations, Assessment, Development and Evaluation (GRADE) approach for grading the certainty of evidence will be followed (GRADE Working Group, 2012) and a Summary of Findings will be created using GRADEpro GDT (Schünemann et al., 2013), (McMaster University, ON, Canada). The Summary of Findings will present the following information where appropriate: estimates of relative risk, and a ranking of the quality of the evidence based on the risk of bias, directness, heterogeneity, precision, and risk of publication bias of the review results. The outcomes reported in the Summary of Findings will be Correlation coefficients A1 - Marking KPI and Marking PPS – A2. KPI Marking and OHSMS Marking – A3. KPI Marking – RA Marking

With values a) greater than 0.8 b) between 0.6-0.8 c) between 0.4-0.6 d) between 0.2-0.4 e) less than 0.2 and

p-values for the aforementioned correlations a) less than 0.1 b) between 0.1-0.9 and c) greater than 0.9.

8.   Conclusion

This study consists of a scientific protocol. The conclusions of the final study will be depended on the results. If a very important relationship between the institutional representations and the KPI's studies is going to be proved, then the research question will be confirmed. If a fake relationship between the institutional representations and the KPI's studies is going to be proved, then the research question will not be confirmed. In any case, the conclusions will be depended by the results that will be found.

Acknowledgements

Declarations

This is a research protocol for Postdoc research being carried out in the University of West Attica.

Availability of data

The data of our research will be available upon request.

Conflict of interest

Authors declares that they have no competing interests.

References

Aromataris, E, & Munn, Z. (Eds). (2020). *JBI Manual for Evidence Synthesis.* JBI Available from: https://synthesismanual.jbi.global

Asih, I., Purba, H. H., & Sitorus, T. M. (Eds). (2020). Key Performance Indicators: A Systematic Literature Review. Journal of Strategy and Performance Management, 8(4), 142-155. https://doi.org/10.7777/jiemar.v1i2

Cheng, S.Y., Lin, K.P., Liou, Y.W., Hsiao, C.H., & Liu, Y.J. (2019). Constructing an active health and safety performance questionnaire in the food manufacturing industry. *International Journal of Occupational Safety and Ergonomics (JOSE), 27*(2), 351-357. https://doi.org/10.1080/10803548.2019.1586369

European Agency for Health and Safety at Work (2022). *Key Performance Indicators 2022.* European Union. https://osha.europa.eu/en/tools-and-publications/infographics/key-performance-indicators-2022

Farantos, G. & Dounias, G. (2023). Key Performance Indicators in Occupational Health and Safety of Hospitals: A systematic review and meta-analysis. Open Science Framework (OSF). https://doi.org/10.17605/OSF.IO/JA4R2

GRADE Working Group (2012). *Grading of recommendations assessment, development and evaluation (GRADE).* The GRADE Working Group. https://synthesismanual.jbi.global

Khapre, M., Agarwal, S., Dhingra, V., Singh, V., Kathrotia, R., Goyal, B. et al. (2022).

Comprehensive structured training on occupational health hazards and vaccination: A novel initiative toward employee safety. Journal of Family Medicine and Primary Care, 11(7), 3746-3753. https://doi.org/10.4103/jfmpc.jfmpc_2333_21

La Fata, C. M., Giallanza, A., Micale, R., & La Scalia, G. (2021, November). A Structured Methodology for the Safety Key Performance Indicator Prioritization: A Case Study. In 2021 5th International Conference on System Reliability and Safety (ICSRS) (pp. 143-147). IEEE. https://doi.org/10.1109/ICSRS53853.2021.9660629

Liu, H. C., & Itoh, K. (2013). Conceptual framework for holistic dialysis management based on key performance indicators. Therapeutic Apheresis and Dialysis, 17(5), 532-550. https://doi.org/10.1111/1744-9987.12019

Munn, Z., Aromataris, E., Tufanaru, C., Stern, C., Porritt, K., Farrow, J. (2019). The development of software to support multiple systematic review types: the Joanna Briggs Institute System for the Unified Management, Assessment and Review of Information (JBI SUMARI). *International Journal of Evidence-Based Healthcare (Int J Evid Based Healthc),* 17(1), 36-43. https://doi.org//10.1097/XEB.0000000000000152

Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T.C., Mulrow, C.D., et al. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. International Journey of Survey 2021(88), 105906 https://doi.org/10.1016/j.ijsu.2021.105906

Pęciłło, M. (2016). The resilience engineering concept in enterprises with and without occupational safety and health management systems. Safety Science. 2016(82), 190-198. https://doi.org/10.1016/j.ssci.2015.09.017

Peters, M.D.J., Godfrey, C., McInerney, P., Munn, Z., Tricco, A.C., Khalil, H. Chapter 11: Scoping Reviews (2020 version). In: Aromataris E, Munn Z (Eds.). JBI Manual for Evidence Synthesis (JBI), 2020. https://doi.org/10.46658/JBIMES-20-12

Schultz, C.C., Shaffer, S., Fink-Bennett D., & Winokur, K. (2016). Key performance indicators in the evaluation of the quality of radiation safety programs. *Health Physics, 111*(2), S155-S165. https://doi.org/10.1097/HP.0000000000000545

Schünemann, H., Brożek, J., Guyatt, G., Oxman, A. (Eds.) (2013). *GRADE handbook for grading quality of evidence and strength of recommendations.* The GRADE Working Group. Available from: https://guidelinedevelopment.org/handbook

Setiawan I., & Purba, H.H. (2020). A Systematic Literature Review of Key Performance Indicators (KPIs) Implementation. *Journal of Industrial Engineering and Management Research (JIEMAR), 1*(3), 200-208. https://doi.org/10.7777/jiemar.v1i3.79

Silvestri, A., Falcone, D., Di Bona, G., Forcina, A., Gemmiti, M. (2021). Global performance index for integrated management system: GPI-IMS. *International Journal of Environmental Research and Public Health (Int. J. Environ. Res. Public Health)*, 18(13), 7156. https://doi.org/10.3390/ijerph18137156

Tufanaru, C., Munn, Z., Stephenson, M., Aromataris, E. (2015). Fixed or random effects meta-analysis? Common methodological issues in systematic reviews of effectiveness. International Journal of Evidence-based Healthcare (In J Evid Based Healthc), 13(3), 196-207. https://doi.org/10.1097/XEB.0000000000000065

Wagner, A., Rieger, M.A., Manser, T., Sturm, H., Hardt, J., Martus, P. et al. (2019). Healthcare professionals' perspectives on working conditions, leadership, and safety climate: a cross-sectional study. *BMC health services research, 1*(1), 1-14, https://doi.org/10.1186/s12913-018-3862-7

Walters, D., Johnstone, R., Bluff, E., Limborg, H.J., Gensby, U. (2022). Prevention services for occupational safety and health in the European Union: Anachronisms or supports for better practice?. *Safety science, 152*,105793. https://doi.org/10.1016/j.ssci.2022.105793

Appendix I: Search strategy
Scopus (Ovid)
Search conducted on August 03, 2023.
Table 2: Search strategy table.

Search	Query	Records retrieved
#1	(Protective Preventive Services) OR (Protective Services) OR (Preventive Services) OR (Safety Technician) OR (Occupational Doctor) OR (Occupational physician) OR (Risk Assessment) OR (Occupational Health Safety Management Systems)	1,653,610
#2	(Key Performance Indicators OR KPI) OR (Occupational Health Safety OR OHS) AND (Hospitals OR Health Units)	2,496
#3	#1 AND #2	917
Limited to 03/08/2013, English or French language.		

PubMed (Ovid)
Search conducted on August 05, 2023.
Table 3: Search strategy table.

Search	Query	Records retrieved
#1	(Protective Preventive Services) OR (Protective Services) OR (Preventive Services) OR (Safety Technician) OR (Occupational Doctor) OR (Occupational physician) OR (Risk Assessment) OR (Occupational Health Safety Management Systems)	984,754
#2	(Key Performance Indicators OR KPI) OR (Occupational Health Safety OR OHS) AND (Hospitals OR Health Units)	34,190
#3	#1 AND #2	5781
Limited to 05/08/2013, English or French language.		

Appendix II: Data extraction instrument

The standardized tool has been modified in a way to include the concepts we are looking for in our research.

Table 4: Date extraction instruments table

Data extraction instrument elements	Sub-categories	Result
Scoping Review Details	Scoping Review title:	
	Review objective/s:	
	Review question/s:	
Inclusion/Exclusion Criteria Population		
	Concept	
	Context	
	Types of evidence source	
Evidence source Details and Characteristics	Citation details (author/s, date, title, journal, volume, issue, pages)	
	Country	
	Context	
	Participants	
Details/Results extracted from source of evidence (in relation to the concept of the scoping review) – KPI's	Key Performance Indicators OR KPI references.	
	Object of the study	
	List of assigned KPI's	
Details/Results extracted from source of evidence (in relation to the concept of the scoping review) – PPS	Protective and Preventive Services OR PPS references	
	Safety Technician OR ST references	
	Occupational Physician OR OP references	
Details/Results extracted from source of evidence (in relation to the concept of the scoping review) – RA and OHSMS	Risk Assessment OR RA references	
	Occupational Health and Safety Management System or OHSMS references	